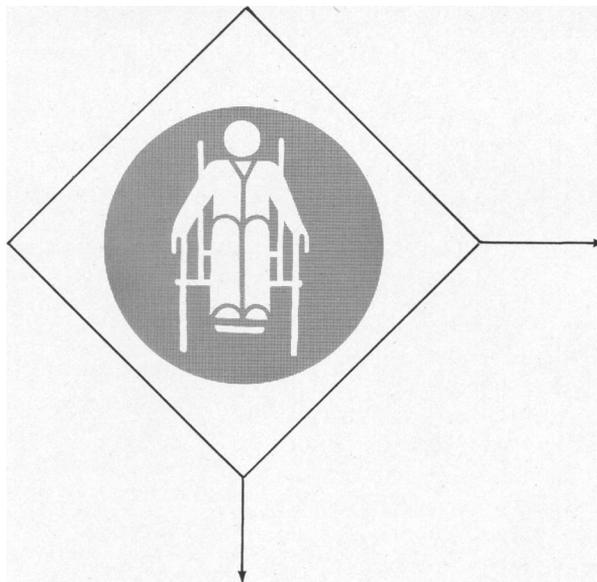


# An Analysis of the Processing of Patients in a Rural Medical Care Delivery System



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A PATIENT FLOW ANALYSIS was undertaken at the rural component of an experimental medical care delivery system to identify the primary factors affecting patient movement through the clinic facility from arrival to departure. The uniqueness of the experi-

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mental physician extender system and its potential for structural replication warranted an accurate recording of its operation from the patient's perspective.

The development of a medical care delivery system to meet the needs of a small rural New Mexico community without a physician began 7 years ago. Among its aims are the provision of immediate care to accident victims and patients with acute illnesses, the maintenance and care of patients with chronic conditions, and the administration of health examinations to all family members. Initiated in 1969 on a fee-for-service basis, the delivery system links a rural clinic staffed by a family nurse practitioner, a laboratory aide, and a clerk-receptionist; supervisory physicians are located about 60 miles away in a metropolitan area. The modern rural facility is equipped and staffed to perform selected laboratory tests, roentgenographic examinations and telephone-linked electrocardiography. After recording a history and performing an initial examination of the patient, the family nurse practitioner communicates her findings by telephone to a supervisory physician. A discussion of the patient's condition may necessitate further diagnostic tests or result in a specific treatment being prescribed by the physician.

A separate analysis of the disposition of patient visits showed that 9 of every 10 encounters were promptly managed at the rural clinic. Furthermore, during a 3-

year period, medical care was provided to at least one member of more than two-thirds of the households located in the county catchment area. The development of this experimental medical care delivery system has been previously reported (1-3).

From an administrative viewpoint, it was important to identify, assess, and correct clinic operational problems as well as to modify system policies in order to improve the efficiency of medical care delivery. A patient flow analysis provides an overview of a system's ability to process patients by revealing interactions among visits from successive patients and between patient and provider.

## Methods

Time study data were collected to describe the movement of patients through the rural facility (4). A pilot study had indicated that a trained nonparticipant observer could record the concurrent processing of patients from an inconspicuous, centrally located vantage point at the facility. The observer recorded the time of discernible patient service procedures to the nearest whole minute at their start and completion. No attempt was made to document the activities within an examination room. Additional items of data were recorded on certain patient, visit, and system variables that were believed to be related to the time required to process a patient. A copy of the data collection form that the observer completed for each patient visit may be obtained from me upon request.

A sampling plan was designed to control for weekly and seasonal fluctuations in patient visit rates. A table of random numbers was used to determine the observation dates so that each day of the week in each of 12 consecutive months was included. Data were collected on every patient visiting the clinic during a study day. Clinic staff members were briefed on the nature and purpose of the research, but they were not informed of the sampling schedule.

Observations of the patient flow were recorded on 60 working days; 48 were full days, and 12 were half days, since appointments were not scheduled on Wednesday mornings. During the sampling interval, 539 patient visits were recorded. Because of unusual circumstances associated with certain visits (such as the presence of a supervisory physician at the rural clinic, visits from relatives of staff personnel, and the arrival at unexpected times of patients who had scheduled appointments), 54 of the total visits were excluded from the analysis.

To avoid biasing the results, the sample of patient visits was divided into two subgroups for descriptive analysis. The 217 patient visits made during the first 27 complete working days of the sampling interval was considered to be the first subsample. The second subsample consisted of the 268 patient visits that occurred during the last 27 complete working days of the sampling interval. A complete working day was either one

full day or two half-days. On the majority of days in the first period, data were not collected for patients who visited the clinic solely to have their throats swabbed and for a culture or for patients who arrived during the noon hour for a later appointment. These omissions in the first subsample could systematically bias the analysis. Therefore, certain results are presented only for members in the second subsample, for whom all visits had been recorded.

## Results

**Patient visit characteristics.** In table 1 visits to the clinic during the data collection period are classified by the patient's age and sex. Females made 57.2 percent of all clinic visits in the period. Women in the child-bearing age group accounted for more than 20 percent of the total visits made by both sexes. Slightly more than one-half of the visits resulted in treatment for an acute illness, whereas on approximately one of five visits the patient sought care for a chronic condition.

More than one-half of all visits observed in the second subsample resulted from previous encounters by the patients for the same condition, and most of these were system-initiated followup visits. One of every four visits was made by a patient who was linked to one or more other patients having contiguous appointments. Although Spanish was spoken in the households of 40 percent of the patients visiting the clinic, only 9 percent of the total encounters were conducted entirely in Spanish.

Patient visits in the second subsample were categorized by appointment status and time of arrival. Table 2 shows that 6 of every 10 visits were scheduled appointments. A Kolmogorov-Smirnov test showed that there was not a significant difference ( $P = .05$ ) between the arrival patterns throughout the day for scheduled and unscheduled visits. Regardless of appointment status, peak visit rates were observed during the first hour of clinic operation and minimum visit rates during the noon hour and the hour before closing. Although the average daily visit rate was 10 patients, it ranged from a low of 4.7 on Wednesdays to a high of 12.0 on Thursdays. The total visits were divided equally between mornings and afternoons. However, since data were collected on Wednesdays only in the afternoon and

Table 1. Percentage distribution of visits of total patient sample to the rural clinic, by age group and sex

Age group (years)	Visits by males (N=207)	Visits by females (N=278)	Total visits (N=485)
Less than 2	6.8	1.4	3.7
2-14	25.1	21.2	22.9
15-44	28.5	36.8	33.2
45-64	18.8	19.4	19.2
More than 64	20.8	21.2	21.0

**Table 2. Visits in second subsample, by time of day of patient's arrival and visit arrangement**

Time of day and visit arrangement	Number	Percent
<b>8:30 am—12m</b>		
Scheduled .....	88	65.2
Unscheduled .....	47	34.8
<b>Total .....</b>	<b>135</b>	<b>100.0</b>
<b>12:01—5 pm<sup>1</sup></b>		
Scheduled .....	74	55.6
Unscheduled .....	59	44.4
<b>Total .....</b>	<b>133</b>	<b>100.0</b>
<b>Both times</b>		
Scheduled .....	162	60.4
Unscheduled .....	106	39.6
<b>Total .....</b>	<b>268</b>	<b>100.0</b>

<sup>1</sup> Observations included 28 patient visits recorded only in afternoon on 6 Wednesdays.

because the morning session (8:30 am–12m) was shorter than the afternoon session (1–5 pm), visit rates were actually higher during the morning hours.

The short average patient waiting time until first service, about 20 minutes, was probably due to the clinic's relatively low daily visit rate. In table 3, the average waiting times for the total sample of patient visits are compared with those for patient visits to other ambulatory facilities. Fetter and Thompson (5) have defined waiting times as follows: first waiting time is the length of time patient waits from arrival to appointment time; true waiting time is time between appointment and admission to examination room; total primary waiting time is total length of time patient waits before admission to examination room. The total primary waiting time includes the period before the appointment time (a waiting time that the patient arriving early for an appointment imposes upon himself), as well as the true waiting time. Furthermore, it encompasses the only waiting time that is recorded for patients without appointments.

Approximately two of three clinic patients with scheduled appointments arrived before their appointed time, and an additional 12 percent were less than 5 minutes late. On the average, patients who arrived after their scheduled appointment had shorter primary waiting times than those who arrived before their appointments. The results of a Kolmogorov-Smirnov test indicates that the distributional pattern of waiting time of patients arriving at the rural clinic without an appointment was not significantly different ( $P = .05$ ) from that of scheduled patients. The policy of the clinic was to attend to the needs of patients with appointments before serving patients without appointments except when an unscheduled patient required immediate atten-

tion. On three of every four unscheduled visits, the patient was seen within one-half hour of his arrival.

The mean true waiting time for all visits was just over 10 minutes. Although universal standards have not been established for patient waiting times, in a study conducted by the Nuffield Trust (6) it was recommended that 75 percent of all patients should be seen within 30 minutes of their appointment times and that not more than 3 percent should have to wait longer than an hour for medical service. Analysis of the sample data indicated that the service provided by the experimental rural delivery system was within these recommended guidelines.

**Table 3. Comparative average waiting time for patients visiting various ambulatory medical care facilities**

Type of facility and visit arrangements	Average waiting time in minutes		
	1st	True	Total primary
<b>Rural clinic studied:</b>			
Scheduled visits .....	9.2	10.8	20.0
Early arrivals .....	13.2	8.9	22.1
Late arrivals .....	...	...	15.2
Unscheduled visits .....	...	...	21.7
<b>Group practice clinic using family physician:<sup>1</sup></b>			
Scheduled visits .....	...	29.1	28.4
Unscheduled visits .....	...	...	20.2
<b>Outpatient specialty clinics in U.S.</b>			
<b>Air Force Hospital A:<sup>1</sup></b>			
Scheduled visits .....	...	25.8	31.4
Unscheduled visits .....	...	...	31.7
<b>Outpatient specialty clinics in U.S.</b>			
<b>Air Force Hospital B:<sup>1</sup></b>			
Scheduled visits .....	...	18.0	24.3
Unscheduled visits .....	...	...	31.7
<b>Student health service outpatient clinic:<sup>2</sup></b>			
Scheduled visits .....	...	...	26.0
Unscheduled visits .....	...	...	27.8
<b>General outpatient clinic in Zuni Indian Hospital (all visits)<sup>3</sup> .....</b>			
...	...	...	46.2
<b>Average of 8 hospital clinics in New York City (all visits):<sup>4</sup></b>			
Medical clinics .....	...	...	76.5
Pediatric clinics .....	...	...	58.3
Prenatal clinics .....	...	...	82.0
<b>General medicine clinic in teaching hospital (all visits)<sup>5</sup> .....</b>			
...	...	...	80.0

<sup>1</sup> Source: Reference 5.

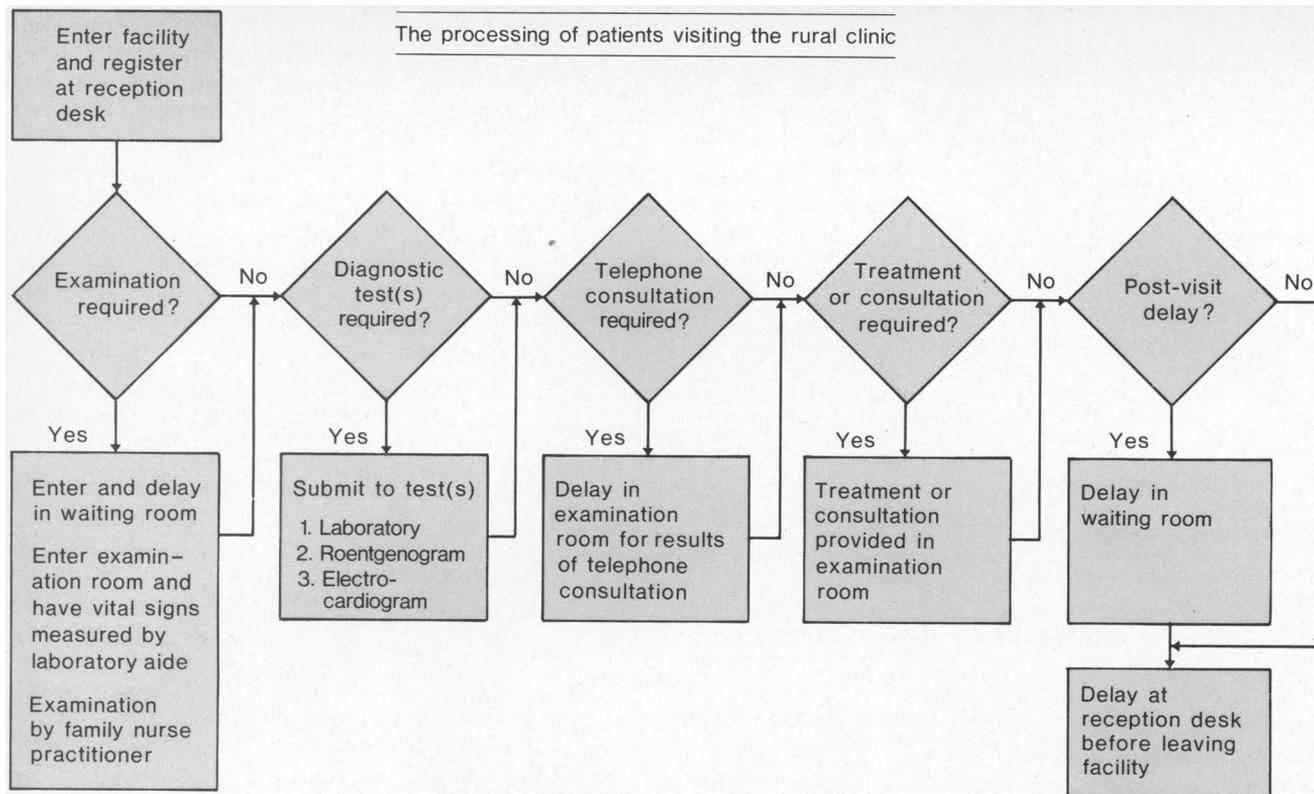
<sup>2</sup> Source: Rising, E. J., Baron, R., and Averill, B.: A systems analysis of a university-health-service outpatient clinic. *Operations Res* 21: 1030-1047 (1973).

<sup>3</sup> Source: Reference 10.

<sup>4</sup> Source: Johnson, W. L., and Rosenfield, L. S.: Indices of performance in ambulatory care services. *Med Care* 7: 250-260 (1969).

<sup>5</sup> Source: Reference 11.

NOTE: Leaders (...) indicate no report or that category does not apply.



**Patient processing.** A schematic illustration of patient processing at the clinic is shown in the chart. Although the patient's route through the system was governed by his needs, this diagram identifies the set of activity sequences that patients frequently followed between their entry and departure from the rural facility. The five points of decision permitted a large number of paths to be considered, but a patient was usually processed in the following manner. After checking in with the clerk-receptionist, the patient remained in the waiting room until called by the laboratory aide to the examination room; there height, weight, and vital signs were measured. Next, an initial examination was performed by the family nurse practitioner, who might request that certain diagnostic tests be conducted. After completing the examination or upon receipt of the diagnostic test results, or both, the family nurse practitioner conferred by telephone with a supervisory physician. The prescribed treatment was administered during the final consultation with the patient. The system's policy was to require a patient receiving an injection to remain in the clinic for 30 minutes. Before departing, the patient arranged with the clerk-receptionist for payment and perhaps also scheduled a future appointment.

On nearly all (90.3 percent) of the visits observed in the second subsample, the patients were examined and treated by the family nurse practitioner. Almost 85 percent of the patients also had a pre-examination check performed by the laboratory aide. Smaller proportions of the visits resulted in the performance of diagnostic tests; one or more laboratory tests were done

during 45.7 percent of the visits; roentgenographic examinations were required during 6.7 percent of the visits; only 3 of every 100 visits resulted in an electrocardiographic examination. Visits requiring a telephone consultation with a supervisory physician occurred 63.4 percent of the time. On only 14.6 percent of the visits did the patients require an injection and thus experienced a post-visit delay because they had to be monitored for a potential adverse pharmaceutical reaction.

The time spent at various clinic stations by patients whose visits were included in the second subsample is summarized in table 4. Slightly more than one-half of

Table 4. Time patients in second subsample spent at various stations in rural clinic

Station	Visits <sup>1</sup>		Minutes at station		
	Number	Percent	Median	Mean <sup>2</sup>	Range
Reception desk ..	146	54.5	3	4.3	1-51
Waiting room ....	252	94.0	22	32.1	1-131
Examination room .	241	89.9	35	43.1	1-165
Roentgenographic					
room .....	18	6.7	9.5	11.9	2-30
Laboratory .....	32	11.9	1	2.0	1-13
Toilet .....	74	27.6	3	4.6	1-28
All stations <sup>3</sup> .....	268	100.0	70	73.7	2-260

<sup>1</sup> Only visits on which patient spent at least 1 minute at station.

<sup>2</sup> Average time spent at given station by patients who were at station for at least 1 minute.

<sup>3</sup> Components do not add to these sums because not all patients were at every station during their visits.

the visits resulted in at least a minute at the clerk-receptionist's desk. For many visits, only a brief acknowledgement by the clerk-receptionist of the patient's arrival and departure was observed. Nearly all patients spent some time in the waiting and examination rooms. Patients spent an average of 94 percent of their total time in one or both of these rooms. The preparation and positioning of the patient accounted for most of the time spent in the roentgenographic room. Specimens for laboratory tests were obtained in either the examination room, laboratory, or toilet.

For patients requiring a pre-examination check, an average of 5.5 minutes was consumed by the laboratory aide in measuring and recording the vital signs. An average of 12 minutes per visit was spent by the family nurse practitioner in examining and treating each patient in the second subsample. Comp and Bergman (7) of the University of Washington reported that the average time spent by an internist per patient visit was 15.7 minutes. For general practitioners in Missouri (8), the average time per patient visit spent in direct patient care was 10.4 minutes. Practicing pediatricians in the State of Washington (9) spent an average of 11 minutes per patient. Although the patient loads and mixes of the providers cited may differ, in general the experimental delivery system in New Mexico appeared to be similar to that of other primary care providers in the amount of time spent in direct patient contact per visit.

A policy was instituted in the system in order to adhere to State legal requirements that a family nurse practitioner refer all patient problems to a licensed medical physician for diagnosis and instructions for treatment. The policy required the family nurse practitioner to have a telephone consultation with a supervisory physician for each patient problem unless the problem was subsumed by her standing orders or unless the sole purpose of the patient's visit was to supply a specimen for laboratory analysis. An evaluation of the telephone communication procedure showed that on the average approximately 12 minutes were required to establish contact with the physician and to discuss the patient's condition and treatment. This time was equally divided between the initiation of the communication via an electronic paging device and the actual discussion of the patient's condition. Fifty-three percent of all visits were managed with one telephone call. The time required to locate the physician was within 10 minutes for three of every four visits requiring consultation. For only 12 percent of all observed visits, were conferences lasting longer than 10 minutes recorded. The family nurse practitioner often discussed more than one patient during a given telephone consultation.

Additional analyses of the data recorded for the second subsample indicated that during a visit, patients spent only an average of 18.6 minutes in direct contact with clinic personnel. In other words, during approximately one-fourth of the total time of an average clinic visit, the patient was attended. Thus, three-fourths of

the average patient's visit could be perceived as waiting time. Fifty-five percent of the unattended time was spent in the waiting room; 45 percent was spent in an examination room.

## Discussion

One of the primary purposes for analyzing the processing of patients at the rural facility of the delivery system was to identify constraints on the flow of patients through the clinic. The length of an average clinic visit was 74 minutes, which compares favorably with that for other primary care clinics (10,11). However, from the patient's perspective, the system could be considered to entail excessive waiting time, especially since the average patient visit rate was only 10 encounters per day. The ratio of the average waiting time to the average total time spent in the system indicates how well the system conserves the patient's time, and it may influence patient satisfaction. An analysis of the patient processing data suggested some modifications in operational policies that would decrease the amount of time patients spent in the clinic unattended.

The distribution of patients' arrivals by time of day showed that visit rates were higher during the morning hours. Therefore, shifting of scheduled appointments from the morning to the afternoon would probably yield a more uniform pattern of arrivals throughout the day. Although this scheduling adjustment probably would have only minimal impact under existing daily visit rates, as demand approached the system's capacity, the need to modify the appointment schedule would become more apparent.

As mentioned, on the average visit, only about one-half of the 20 minutes spent by the patient in the waiting room unattended was governed by the system's appointment policy; the other half was self-imposed by the patient's early arrival. The study data indicated that the two primary care examination rooms at the clinic were occupied less than half of the time. Provided there were no other constraints on patient flow in the system, an average reduction in the total primary waiting time of approximately 10 minutes appears to be readily attainable by ushering patients to an unoccupied examination room as soon as possible after their arrival. This policy is definitely feasible under existing daily rates at the rural clinic. Moreover, it has the potential of increasing patient satisfaction by reducing the average time a patient spends unattended during a clinic visit. On the other hand, since a substantial majority of patients with appointments arrive early, depriving them of an opportunity to socialize in the waiting room might alter their level of satisfaction with the delivery system.

Certain clinic policies that resulted in delays in patient processing, such as the one-half hour period for monitoring a patient receiving an injection, should of course remain in force to insure the delivery of good medical care and the patient's safety. Patients also spent

time in the waiting room to complete registration forms, to wait for other patients with whom they were sharing transportation, or to converse with friends who were also visiting the clinic. These factors are outside the control of the system.

Patients spent an average of 25 minutes unattended in the examination room. One-half of this time was accounted for by the system's policy of requiring a telephone consultation for all patients' conditions that were not subsumed by the family nurse practitioner's standing orders. Expanding this set of standing orders to include most of the more common acute and chronic conditions of adults would reduce the frequency of telephone consultations and, in turn, would decrease the amount of unattended time spent by patients in the examination room. Some additional time also could be saved during those visits requiring physician consultation if the telephone paging procedure were replaced with direct-dial calls. The remaining proportion of unattended time spent in the examination room can be primarily attributed to the patient's waiting while laboratory tests were being performed and films from roentgenographic examinations were being developed. An analysis of the performance priorities associated with the diagnostic tests did not reveal any inefficiencies that could be corrected through procedural modifications.

During the past 6 years, the delivery system has evolved from an experimental project to a viable program for providing medical care in a rural community without a physician. Since completion of this study, a private nonprofit agency has assumed administration of the delivery system for this rural New Mexico community, and several changes in policy have been implemented. These modifications included the movement of patients to an unoccupied examination room as soon as possible after their arrival and a revised and expanded set of standing orders for the family nurse practitioner. Implementation of these new standing orders has reduced the required telephone-linked physician consultation from 63 percent of all patient visits

to between 10 and 15 percent. Thus, besides identifying several impediments to the processing of clinic patients, the investigation produced useful information for evaluating alternative medical and administrative policies.

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## SYNOPSIS

REID, RICHARD A. (University of New Mexico): *An analysis of the processing of patients in a rural medical care delivery system. Public Health Reports, Vol. 91, September-October 1976, pp. 471-476.* A study of the processing of patients at the rural clinic of a medical care delivery system was done to describe quantitatively the movement of patients from their arrival to their departure. The data collected provided

a statistical summary of the sequence and duration of observed events in the medical care process as they related to the patients. An analysis of 485 patient visits that were observed on 60 random days during a 12-month period showed that patient arrival rates were generally higher during the morning. The average visit lasted 74 minutes; 94 percent of this time was spent in the waiting and examination rooms. The period

that the patient spent unattended by clinic personnel represented three-fourths of the average patient's total time in the delivery system. Data analysis indicated that if patients were admitted to an unoccupied examination room as soon as possible after their arrival and if standing orders for the family nurse practitioner were expanded, a significant reduction would occur in the average patient's unattended visit time.